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# ILLINOIS ENGINEER



NEW STATE OF ILLINOIS OFFICE BUILDING, SPRINGFIELD



THE ILLINOIS ENGINEER, JANUARY, 1956—VOLUME XXXII, NO. 1

# ILLINOIS SOCIETY OF PROFESSIONAL ENGINEERS, Incorporated

Affiliated with the National Society of Professional Engineers

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# Of Interest to I. S. P. E.

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## PRESIDENT'S MESSAGE

The New Year is just beginning and for your consideration I wish to submit the following Schedule of Maximum DO'S and DON'T'S for 1956—

*First*—The Illinois Professional Engineering Act" as enacted July 20, 1945, is long past due for a revision of standards and qualifications. It is the professional duty of all Professional Engineers, and especially a *MUST DO* for the ISPE to exert the major portion of their efforts and cooperation in preparing the necessary Amendments to be submitted to the next General Assembly.

*Second* — Preliminary studies are being prepared and will be presented for review for the Illinois Association

of Highway Engineers to unite with the ISPE as a Functional Group. It is a *MUST DO* for all Professional Engineers to consider this merger which will not only increase professional recognition and public relations, but may well pave the way for other Functional Groups to merge with the ISPE for the unity of all Professional Engineers.

*Third*—A membership roll of 2000 is a *MUST DO* for 1956. Statistics show that the reason for a majority of Engineers not belonging is because they have never been properly invited.

DON'T forget your most precious commodity is TIME, which ticks faithfully on day or night, and cannot be replaced or returned by even your engineering ability and knowledge. It is TIME you gave willingly, freely, and Professionally, of your TIME.

DON'T forget to thank your past Chapter Officers for the time and sacrifices they have made to advance your Profession.

DON'T forget to give willingly of your ability and attendance to assist your new Chapter and State Officers in making this year a *MUST DO* year.

DON'T forget that on December 31st a trial balance will be written of your efforts and results for the year 1956. It may not be printed in a statistical report, but I am certain there is a place reserved for the record of your achievements.

DWAIN M. WALLACE, President

Cute Co-Ed : "Stop that man! He wanted to kiss me."  
Engineering Student : "That's all right, Miss, there'll be another along in a minute."



President Wallace

## Vox Secretarii

By P. E. ROBERTS, Executive Secretary

### Combines and Mergers

In the world of business, combines and mergers are constantly taking place with little notice being taken except on the financial pages. The merger of Studebaker-Packard and that of Nash-Hudson were made for the purpose of effecting basic economies in the avoidance of duplication, etc. In fact, the mergers were of such importance that they were probably made necessary for economic survival.

The largest merger, and one which many people said could never be accomplished, was that of combining the A. F. of L. and the C. I. O. There was not much consideration of economic survival in this merger, but there was considerable advantage to it in that the combined totals of the two unions have made a tremendously powerful group.

Numerous instances can be cited where mergers of fraternities, church groups and others of a similar nature have proved eminently successful. There is usually little question as to the value of any merger. Therefore, the question of not "Shall we do it?" but "How can we accomplish it?" becomes of prime importance. To find a common ground, some concessions must be made and the concessions must be made by both parties who will ultimately benefit by the merger.

If and when the time comes that the proposed merger affecting the future of the Illinois Society is presented, your thoughtful immediate attention will be greatly appreciated.

### To Chapter Officers:

This is the time of year when new Chapter officers are elected and take office in their respective Chapters. The

(Continued on page 4)

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### READ THE ADVERTISEMENTS

### SUBSCRIPTION RATES

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For the Gas Turbine Engine . . .

# THE MILES-PARKER REGENERATOR

by David Webster, F.A.A. '56

A new regenerator for gas turbine engines has been developed by John C. Miles, professor of mechanical engineering at the University of Illinois, and Norman A. Parker, head of the mechanical engineering department.

The project for the development of a future power plant is being jointly sponsored by the Detroit Arsenal of the Army Ordnance Corps and the University of Illinois research board. The main object of this project was to design the best possible power plant for the future and research showed this would best be a regenerated gas turbine.

The modern gas turbine is the ultimate in simplicity and light weight, it will burn fuel oil, kerosene, or JP4 (jet fuel), it has no pistons, valves, distributor, or cooling system. Essentially it is a compressor, a combustion chamber, and a turbine. The turbine is coupled directly to the compressor. There is generally a second turbine immediately behind the first, called the work turbine, and it is used as a power take off.

A gas turbine is small and ideally suited for use in trucks, trains, tanks, and ships, except for its enormous fuel consumption. A regeneration system reduces this gigantic fuel consumption by using the heat from the exhaust gases to preheat the incoming air. The regeneration system developed here by Professors Miles and Parker is so effective that it cuts fuel consumption in half.

The main objection connected with previously developed regeneration systems was their enormous size. Often the regenerator for a stationary turbine would be as big as a box car.

The researchers here at the University have done three things:

1) They have produced a regenerator no bigger than a suitcase. It takes up less than 2 cubic feet of space, and is small enough to go with the turbine under the hood of an automobile.

2) They have discovered a way to let this disc turn freely while exhaust gasses go through two-thirds of it in one direction and incoming air for the

turbine goes through the other third in the opposite direction.

3) They found how to keep exhaust impurities from fouling up the thousands of tiny openings in the disc.

The regenerator is supported by ball bearings running in a race ground into the edge of the disc. The disc is made from hundreds of feet of two No. 347 Stainless steel ribbons, each 6 inches wide and 0.003 inches thick. One is corrugated into tiny accordion pleats, 21 to the inch. The two ribbons are then coiled tightly together, round and round, to form the disc. This disc has more than 63,000 holes per square foot. The size of the disc varies from 18 inches in diameter up, depending on the turbine size.

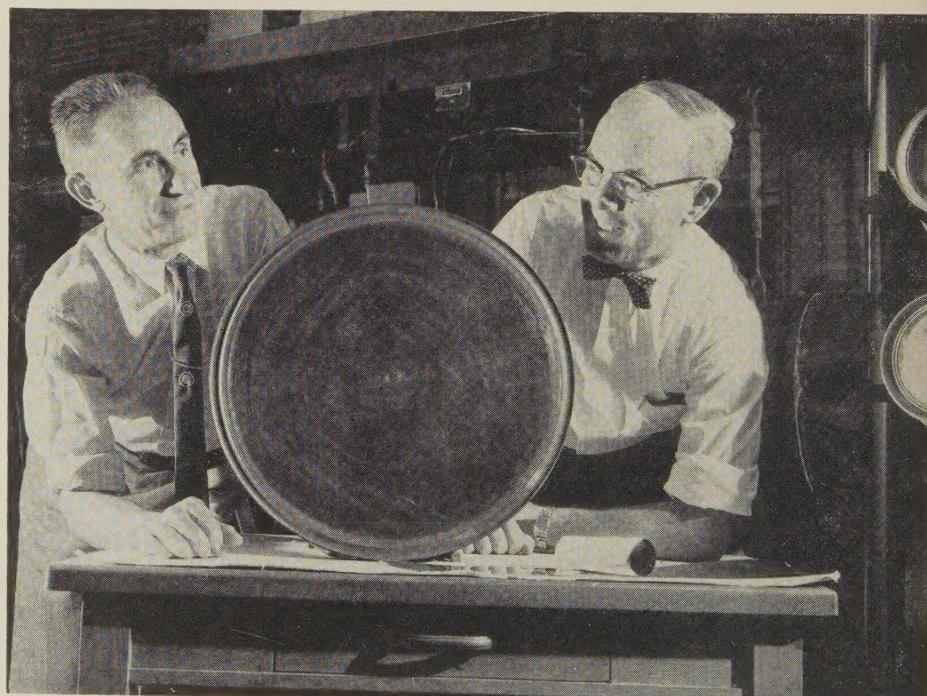
Gasses and air flow with little hindrance through the rotating heat transfer disc because it is actually four-fifths open spaces. The exhaust gasses heat the

disc and the disc heats the incoming air. The exhaust is cooled from 1,100 degrees to 400, and the air is heated to 1,000 degrees.

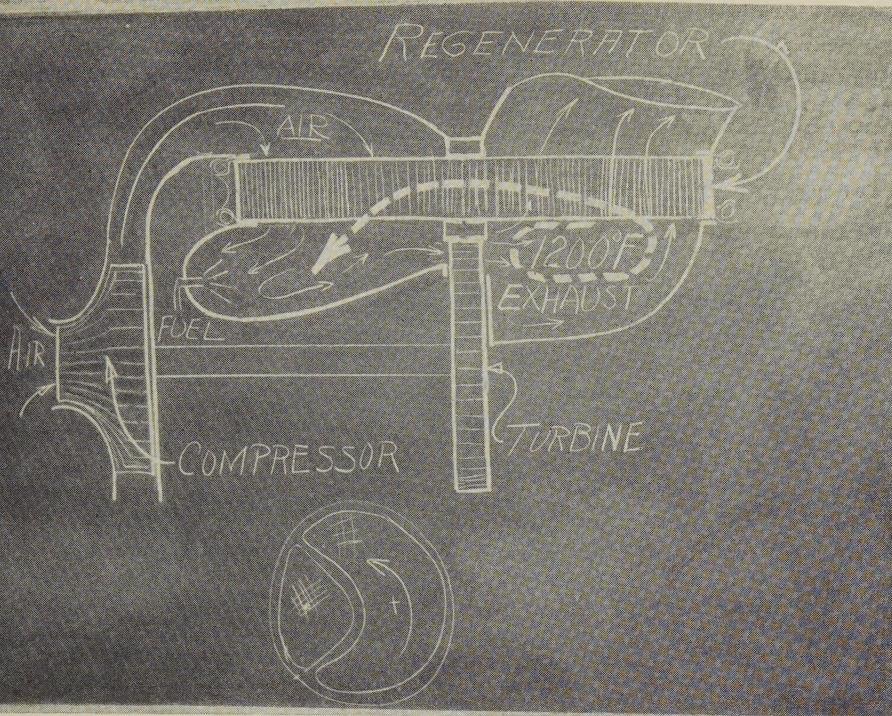
The optimum speed for the regenerator disc is 20 rpm. This was found theoretically using equations involving heat transfer data. This speed also eliminates much of the intermixing of the exhaust and the air due to a carry-over effect called paddle wheeling.

The heart of the Illinois development is the seal which separates exhaust and air sections while the disc turns. Any type of organic seal was immediately ruled out because of the extremely high temperature (1,100 degrees). This means the seal must be metal to metal, or possibly ceramic.

To keep exhaust impurities from fouling the small holes in the disc, a portion of the fuel is injected into the air before the air enters the disc. This fuel-



University of Illinois Professors John C. Miles and Norman A. Parker inspect the matrix of their regenerator. (Staff photo)



An elementary cut-away drawing of the Miles-Parker Regenerator in position on a gas turbine. The heart of the unit, the matrix is shown much enlarged at right. The principle of easy passage of air while retaining a large heating surface area is easily seen in this view. (Photo by Dave Komyathy)

air spray continuously flushes out the openings. Gasoline works very well for this, but at the moment they are still experimenting with kerosene.

At the moment experiments are being conducted to determine the effectiveness of injecting all of the fuel into the air stream before it reaches the regenerator. Thus the heat of the disc could also be used to vaporize the fuel completely, thereby adding to the efficiency of the whole system. This also reduces the pressure differential in the firing chamber which further adds to the efficiency of the system.

A centrifugal compressor has been found to work best with this system because of the low pressure ratio of about 4 to 1. Also a centrifugal compressor is much smaller, more rugged, and cheaper than an axial flow compressor.

Essentially this project was to design an efficient power plant to be used in a tank. Anyone in the tank corps during the Korean "police action" will tell you that our modern day tanks are terribly underpowered. One happy note is the fact that this regenerated gas turbine system developed here can be used in trucks, busses, automobiles, tractors, trains, and bulldozers, to name but a few.

One of the present projects now being undertaken is the development of a 200-300 horsepower engine. Maybe your next car will have one of these engines in it.

#### EDITORIAL COMMENT

In line with the wishes of members of the Society, the Editor is on a constant search for semi-technical articles of current interest. A description of the Miles-Parker Regenerator is such a story.

Professor Norman A. Parker is the head of the Mechanical Engineering Department, University of Illinois, and Professor John C. Miles is a member of the Mechanical Engineering faculty.

The *Illinois Engineer* and its Editor are grateful for the permission to use this story as it appeared in the very fine student engineering magazine, the *Illinois Technograph*. Mr. Paul McMichael, General Manager of the Illini Publishing Company, was most helpful.

This Regenerator, another first for the University of Illinois College of Engineering, might well lead the way toward a widespread use of the gas turbine, both in mobile and stationary prime-movers.

(Continued from page 1)

Executive Secretary extends a cordial welcome to the new Chapter Officers and a grateful "Hello" to those, especially Chapter Secretaries, who are continuing in office. So much of the success of the Illinois Society depends upon the smooth functioning of the Chapters that it is with sincerity that the Secretary's office extends its offer to be of assistance to Chapter officers in any way possible. Your attention is directed again to the Chapter Officers Conference which will be held at the Jefferson Hotel in Peoria at 10.00 a.m., January 28. Many worthwhile ideas have sprung from this conference and both new and continuing Chapter officers are urged to attend. A special welcome is extended to Chapter Presidents, Vice Presidents, Secretary-Treasurers and Membership Chairmen. Any other Chapter officers will be welcome.

#### 71st Annual Meeting

Plans for the 71st Annual Meeting, of which Lake County Chapter is the host, are progressing nicely. The Executive Committee reviewed tentative plans which were presented to the Board of Direction on January 14. The tentative plans as approved by the Board will be given to you in the February issue.

#### Membership

In order to stimulate membership activities, State Chairman Manuel Garcia proposed a contest between the Missouri Society of Professional Engineers and the Illinois Society. The challenge was made and the acceptance received with enthusiasm by Missouri Executive Secretary Paul Doll. Details of the contest will be forthcoming by Mr. Garcia. In the meantime your immediate support by getting a couple of applications signed and sent in will benefit not only the Society, but your Chapter. Your immediate and continued help is needed now.

#### Engineers' Week

National Engineers' Week is but one short month away. The week of February 19 to the 25th is the time for the official celebration. Participation by many Chapters runs all the way from dinner dances and talks to various service clubs about engineering, to window displays and stories in local newspapers. Those of you who are in the viewing area of WCIA TV station will be glad to know that plans are being made to use some material during that week over the station. Also WPTV, Decatur, has indicated that they will cooperate. The times are yet not known, but will be passed along to you either through this column or through the Secretary's Bulletin.

Hotel Proprietor: "Do you want the porter to call you?"

Pipe Pedlar: "No, thanks. I wake up every morning promptly at 7 o'clock."

Proprietor: "Then would you mind calling the porter?"

## Foreword To The Illinois Land Surveyor Questions



Herewith are presented the first group of questions which have been used by the Land Surveyors Examining Committee, Department of Registration and Education, State of Illinois. Your attention is particularly called to the instructions for deputy surveyors written by Edward Tiffin, Surveyor General, North West of Ohio, dated July 26, 1815. There are very few places where these instructions have been completely printed, and since they are of great importance, they are reproduced here for your information and use.

Acknowledgment is gratefully made by the Editor to Mr. H. H. Bremer, Chairman of the Land Surveyor Committee, and also a member of the Illinois Society since 1901. Mr. Bremer says in his letter of transmittal in part, "It is always a pleasure to a fellow to be of service, and in compliance with your request I am sending sample questions propounded during the last 10 or 15 years to candidates for Registration as 'Illinois Registered Land Surveyors'. The publication of such material I feel invites criticism and this is desirable.

"This takes the ego out of the 'Holier than Thou' fellows and should encourage the younger members of our commonwealth to engage in land surveying."

Director Binks, Department of Registration and Education, adds her blessing, and acknowledgment is also made for the splendid help given by Professor Charles S. Danner, also a member of the Illinois Society. Frank H. Allen, Jr. made the drawings.

A second group of questions will appear in the February issue and in the very near future, the two sets of questions will be printed in a book and made available for general distribution at a nominal price.

#### COST OF LIVING INDEX

The cost of living correction factor to be applied to the I.S.P.E. Schedule of Minimum Fees and Salaries is based upon the Consumer Price Index of the 1947-49 average as determined by the Bureau of Labor Statistics. On the 1947-49 base the correction factor for November, 1955, is 115.0.

I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto.

Sir Francis Bacon

# Land Surveyors Typical Questions

Taken from Examinations given by the State of Illinois Department of Registration and Education during 1939 and 1954.

## INSTRUCTIONS FOR DEPUTY SURVEYORS

By E. TIFFIN, Surveyor General of the United States, July 26, 1815

### INSTRUCTIONS FOR SUBDIVIDING TOWNSHIPS

First—When the township lines are completed, you must begin the survey of sections at the Southeast corner of the township, and move on in continued progression from east to west and from south to north in order that the excess or defect of the township as to complete sections may fall on the west and north sides of the township, according to the provisions of the Act of the 10th of May, 1800.

Second—Each side of a section must be made one mile in measure by the chain and quarter section corners are to be established at every half mile, except, when in the closing of a section if the measure of the closing side should vary from 80 chains or one mile, you are in that case to place the quarter section corners equi distant, or at an average distance from the corners of the section, but in running out the sectional lines on the west, or north side of the township you will establish your quarter section posts or corners at the distance of half a mile from the last corner and leave the remaining excess or defect on the west or north tier of quarter-sections; which balance or remainder you will carefully measure and put down in your field notes, in order to calculate the remaining or fractional quarter section on the north and west side of the township; also in running to the western or northern boundary, unless your sectional lines fall in with the posts established therefor the corners of sections in the adjacent townships you must set post and mark bearing trees at the points of intersection of your lines with the town boundaries, and take the distance of your corners from the corners of the sections of the adjacent townships, and note that and the side on which it varies in chains, or links or both.

Third—The sections must be made to close, by running a random line from one corner to another except on the north and west ranges of sections, and the true line between them is to be established by means of offsets.

Fourth—in fractional townships on Rivers it will be necessary to vary from the foregoing rules; and the lines must be continued from the rectilinear boundaries of the township which may be parallel to the river, perpendicularly to those boundaries till they meet the river, the sections however must be made complete on the sides of the townships bounded by straight lines, and all excess or defect of measure must be thrown into the fractional sections on the river; the measure of the lines from the last entire sectional corner should be made very exact in order to calculate the fractional section with exactness.

#### Illustration

Begin at N, the southeast corner of the township, and run west 40 chains, and establish the quarter section corner at n of section 36, if it be not already established, continue 40 chains further and establish the corner at O, of sections 36 and 35; from O run a true north course 40 chains and mark the quarter section corner between 35 and 36, continue 40 chains farther on the north line and establish the corner 25, 26, 35 and 36. From this corner run a random line for the post or

corner of M, without blazing; at the distance of every 20 chains on this line set up a stake or post or mark some other mark on the random line; if you strike the post or corner M exactly, you have only to blaze the lines back and establish the quarter section corner,

(See Figure 1, top next page)

which you will take care to establish at the average distance between the corner at M and the corner between 25, 26, 35, and 36; but if running for the post M you fall north or south of it, you must note the departure or deviation in your field book, and return on the true course observing to correct it by means of offsets from your marks made on the random line.

From the corner of sections 25, 26, 35 and 36, run due north one mile, setting the half mile post as before at 2 on the line, from O to F, return south to O, and establish at O and P your quarter section and section corners; then run north from P and establish quarter section and section corners as before and run a random line from the section corner on the line P E to the corresponding corner on the line O F; proceed in this manner till you arrive to the last corner towards the western boundary of township from M to U, viz; between sections 29, 30, 31 and 32; from this corner run west and at the distance of 40 chains from it, established the quarter section corner at 6, in the line from M to U; continue west till you intersect the town boundary, suppose at U, note carefully the distance of the point of intersection from the last section or quarter section corner, and also the distance of this point from the section corner of the adjacent township west of you, or the distance of U from M and on which side it lies, viz: either north or south; at the point of intersection U set the section post or corner and take bearing trees.

In this manner you will proceed until your township is completed, observing always to move either in a range of sections from that at the southeast corner of the township to the western boundary, or from that section to the northern boundary, but when you shall have completed the sections to the north boundary of the township you will proceed from the last section corners, establish quarter section corners at 40 chains from them, and continue north till you intersect the town boundary in the same manner as on the western side of the township, observing to note the distance at which you intersect the north boundary from the section or quarter section corner you left last. Also you will be careful to note the distance of the point of intersection from the corner of the section of the adjacent township and whether it be on the East or West side of it; then the distance from 6 to F or from 6 to E on the line O F and P E, must be carefully noted in your field notes and also the distance from F where you intersect to O the post on the town above and on which side whether east or west.

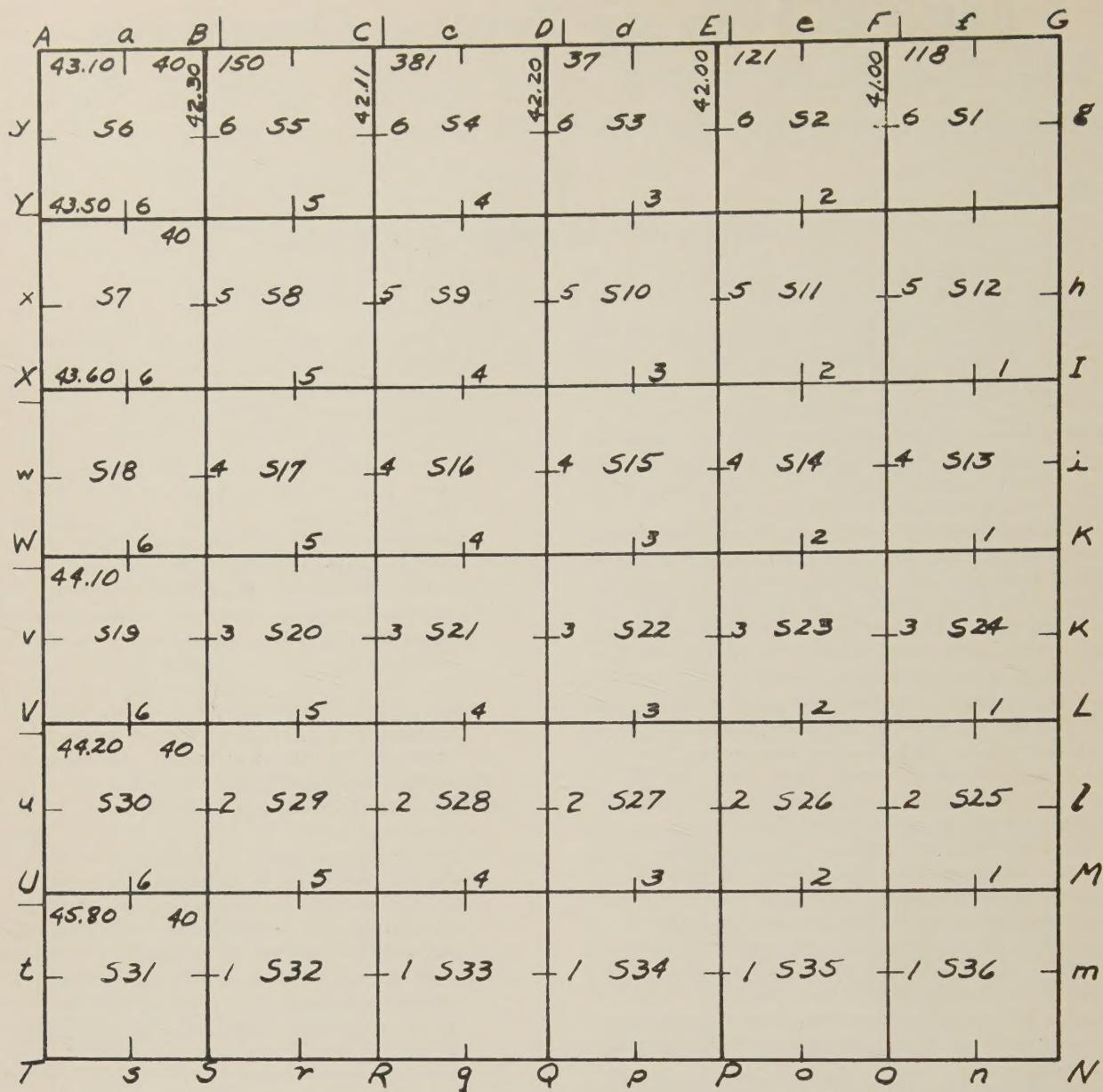


Figure 1

Fifth—Great care must be taken that the north and south lines be run according to the true meridian as required by law, and the east and west lines be run at right angles to them as far as is practicable in closing, but if on running on a true east and west line you find the post you are running for lies very much to the north or south of the lines, you are then to mistrust the measure by the chain, and if possible, the line on which the posts are established must be re-measured; also in running a meridional line by the compass, if you find the measurement of the closing lines of the sections, that is an uniform convergency or diagonally of those lines; you may then reasonably mistrust the accuracy of the direction of your lines by the needle. In such case it will be well to endeavour to run parallel to the meridian adjacent on which section closes, in order that it may contain a just or legal quantity viz: 640 acres or one mile square.

Sixth—As the measurement by the chain is the principal source of errors in surveying, you will be careful to attend to your chaimen, that they carry the chain horizontally and to prevent their loosing a tally rod, you must be provided with a set of them pointed with iron or steel, and to allow no other to be used but the precise number which you shall have selected for the purpose.

Seventh—In meandering Rivers you will take the bearings according to the true meridian of the River and note the distance on any course when the River intersects the sectional lines, and the calculations of the contents of the fractions are to be made by the tables of Difference of Latitude and Departure, and returned on your plats; but the quantity or contents of the whole section only are to be put down; in all the other sections, and each of them is to be accounted one mile square or 640 acres, unless your closing lines deviate very much from 80 chains, in which case you will be careful to put down their true length on your plats.

Eighth—You must frequently while in the field attend to the correction of your chain; for this purpose you should be provided with some measure taken from the Standard chain in the office of the Surveyor General.

Ninth—All random lines, as well as the true, are to be noted in your field book at the time of running them, and are to be kept in the order in which the work is executed, also you must be careful to note the variation of the random lines from the corners or posts which they were intended to strike.

Tenth—All courses of whatever lines, must be taken with the sight of your Compass set to the variation and estimated according to the true meridian for which purpose the varia-

ion of the needle at the place where you survey must be taken or previously known and your Compass regulated to before you commence running the lines.

Eleventh—No lines of whatever description are to be run, or marks of any kind made by any person but yourself, or who may be under the immeditae inspection of yourself or some Deputy Surveyor duly authorized from this office.

Twelfth—Any considerable departure from these instructions will be considered as a forfeiture of the conditions of the contract, or any claim for payment, and loose inaccurate or precipitate work will not be admitted, either as it respects surveys in the field, or their returns on paper.

Thirteenth—You will take care that your posts be well driven into the ground and that there be one or two sight trees marked between every quarter section corner; also at the section corners that there be marks for every section corner where they corner.

#### GENERAL INSTRUCTIONS FOR DEPUTIES

First—You will provide a good compass of Rittenhouses construction, having a nonius division and movable sights, and a two poles chains of 50 links; the chain must be adjusted by the Standard Chain in the Office of the Surveyor General, and it will be of importance that both it and the compass be frequently examined in the field in order to determine any errors and irregularities which may arise from the use of them.

Second—Whenever you may be obstructed by insuperable obstacles, such as ponds, swamps, rivers, creeks, etc., you will take the necessary offsets, or work by a traverse or trigonometry, in order to ascertain the distance on any line which is not actually run.

Third—The courses of all navigable rivers, which may bound or pass through your district must be accurately surveyed and their width taken at those points where they may be intersected by township or sectional lines; also the distance of those points from the sectional corners and from the commencement of any course where you are meandering the River, you will likewise not fail to make special notice of all streams of water which fall in your way with their width and course from whence they appear to come or run.

Fourth—All township or sectional lines which you may survey are to be marked in the manner hitherto practiced in the surveys of the United States lands, viz.: all those trees which your line cuts must have two notches made on each side of the trees where the line cuts; but no spot or blaze is to be made on them, and all or most of the trees on each side of the line, and near it, must be marked with two spots or blazes diagonally or quartering towards the line.

Fifth—The posts must be erected at the distance of every mile, and a half mile from where the town or sectional line commenced (except a tree may be so situated as to supply the place of a post) which post must be at least three inches diameter and rise not less than three feet. All mile posts must have as many notches cut on two sides of them as there are miles distant from where the town or sectional line commenced, but the town corner posts, or trees shall be notched with six notches on each side, and the half mile sectional posts are to be without any marks; the places of the posts are to be perpetuated in the following manner, viz.: at each post, the courses shall be taken and the distances measured to two or more adjacent trees in opposite directions, as nearly as may be, which trees, called bearing trees, shall be blazed on the side next the post and one notch made with an axe on the blaze, and there shall be cut with a marking iron on a bearing tree, or some other tree within and near each corner of a section, the number of the section, and over it the letter T with the number of the township, and above

this the letter R with the number of the range, but for quarter section corners, you are to put no numbers on the trees, they are to be distinguished by this mark  $\frac{1}{4}$  S.

Sixth—You will be careful to note in your field book all the courses and distances you shall have run, the names and estimated diameters of all corner or bearing trees, and those trees which fall in your line called station or line trees notched as aforesaid, together with the courses and distances of the bearing trees from their respective corners, with the letters and numbers marked on them as aforesaid; also all rivers, creeks, springs and smaller streams of water, with their width, and the course they run in crossing the lines of survey, and whether navigable, rapid or mountainous; the kinds of timber and undergrowth with which the land may be covered, all swamps, ponds, stone quarries, coal beds, peat or turf grounds, uncommon, natural, or artificial productions, such as mounds, precipices, caves, etc., all rapids, cascades or falls of water; minerals, ores, fossils, etc.; the quality of the soil and the true situation of all mines, salt licks, salt springs and mill seats, which may come to your knowledge are particularly to be regarded and noticed in your field books.

Seventh—In all measurements the level or horizontal length is to be taken, not that which arises from measuring over the surface of the ground when it happens to be uneven and hilly; for this purpose the chainmen in ascending or descending hills must alternately let down one end of the chain to the ground and raise the other to a level as nearly as may be, from the end of which a plumb should be let fall to ascertain the spot where to set the tally rod or stick; and where the land is very steep, it will be necessary to shorten the chain by doubling the links together, so as to obtain the true horizontal measure.

Eighth—Though the line be measured by a chain of two perches, you are notwithstanding to keep your reckoning in chains of four perches of one hundred links each, and all entries in your field books, and all your plans and calculations must be made according to the decimal measure of a chain.

Ninth—Your courses and distances must be placed in the margin of your field books on the left, for which purpose it should be large, and your remarks made on the right in the manner following:

North		
Chains	Links	Between Sections 35 and 36, Town 4, Range 6.
20	30	A White Oak 20 inch diameter.
37	10	A stream 30 links wide SE.
40	--	Set half mile post, from which a B. Oak 18 inch diameter bears S. 50° E. 40 links, and a sugar tree 15 inch diameter bears N. 10° W. 34 links.
80	00	Set post corner of section No. 25, 26, 35 and 36, township 4 range 6 from which a White Oak 10 inch in diameter bears S. 78° 30' E. distant 20 links, and a Hickory 15 inch diameter bears N. 50° W. 37 links distant.
East		
Chains	Links	Between No. 25 and 36 Town 4, Range 6, on a random A brook 30 links wide, course S. 20° W.
16	40	Set temporary quarter section post.
40	00	This half mile overbroken land.
		Timber Oak, Ash, etc.
64	30	A stream 25 links wide, course SE.
79	90	Intrsected N. & S. line 20 links south of section corner. Over hilly land, soil rich and good for farming.
		Timber, Oak, Hickory, Poplar, Ash, etc.

West

Chains Links Between Sections 25 and 35, Town 4, Range 6 on true line.

39 95 Moved temporary post to the average distance for  $\frac{1}{4}$  section corner, from which a Black Jack 10 inch diameter bears S.  $50^\circ$  E. 100 links, and a White Oak 19 inch in diam. bears N.  $25^\circ$  W. 40 links.

Chains Links

55 00 A White Oak 11 inch in diameter.  
79 90 Section Corner.

In this manner you must enter all courses and distances in your field book, the date must follow the close of each day's work, which field book, written with a fair hand, of each township separately, or a true and fair copy, together with the original you will return to the Office of the Surveyor General.

Tenth—The plat of each township and fractional part of a township must be neatly and accurately protracted on durable

paper, by a scale of 2 inches to a mile, or forty chains to an inch, and must be in such measure and proportions in every line and part as actually was determined by measurement in the field, a compass having the true and magnetic meridian, and the scale by which the lines are laid down, are to be placed on the SE. corner of the plat.

Eleventh—The following certificate must be inscribed on your plat and signed by you.

Pursuant to a contract with, and instructions from

Surveyor General of the United States, bearing

date the day of I have admeasured  
laid out and surveyed the above described township (or fractional part) and do hereby certify that it had such marks and bounds, both natural and artificial as are represented on said plat and described in the field notes made thereof, and returned with the plat in the Surveyor General's office.

Certified this day of

Method by which to calculate the Northern and Western tiers of fractional quarter sections.

Figure 2

A	B	C	D	E	F	G
Y	SEC 6	SEC 5	SEC 4	SEC 3	SEC 2	SEC 1
Y		79 00	80 00	80 00	80 00	80 00
180	41 00	6	R	Q	P	O
X	SEC 7					
X	40 00	6				
W	SEC 18					
W	41 50	6				
V	SEC 19					
V	41 20	6				
U	SEC 30					
U	41 00	6				
T	SEC 31					
T	3					
S						

You will commence, say at the Northeast corner of the township, the length of the line from G to g being 40 chains as established in running the exterior boundary of Township, you will proceed by adding the length of the line from 6 to F on the line from 0 to F which is 42 chains to the length of the line from centre of the section to F on the Town Boundary, which being added to the length of the line G g and divided by two will give you the length of one of the lines required for calculating N. E. quarter of Section No. 1; Then the length of the line from G to F being 40 chains, and the south boundary of the sec. being 80 chains, the length of the line H to 1 is forty chains—the length of the line G to F—therefore there is no necessity for additions or divisions, as the line from 1 to F is parallel to the line GH, then by multiplying those sides together, and cutting off as many decimals as there are in the sums multiplied, and dividing by 10, you have the contents of the N.E. quarter of section 1, in acres and decimals parts of an acre. You will then proceed to calculate the N.W. quarter of the same section by taking the length of the line from the centre of the section to F, as found in your former calculation to which add 42 chains, the length of the line from 6 to F, and divide by two, which gives you the length of one of the lines required. Then as the line from O to F intersected the town boundary 3 chains east of the section corner, the length of the line from F to f is only 37 chains which added to 40 chains (the length of the south line of the southwest quarter of section 1) and divided by two will give you the length of the line from 6 to the centre of the section which being added to 37 and divided by two will give the length of the other line required—which you will calculate in the same manner as above.

As the length of the line from F to f is only 37 chains, the length of the line from o to F must be 43 chains—the length of the line from E to o is 38.50 chains; the length of the line from d to E 41.50 chains, etc., the quarter section corners not being placed at the average distance between the section corners, except when you strike the corners of the sections established in running the exterior lines of the township.

# Practical Surveying

## PS 1—Government Notes

North on line between Sections 3 and 4

40.00 Set  $\frac{1}{4}$  Section Post.

83.04 Intersect the Township Line 93 Links West of post in mound where raised a Mound in which set a post for Corner of Sections.

East on a random line between Sections 4 and 9T N., R E.

40.00 Set Temporary  $\frac{1}{4}$  Sect. Post.

79.94 Intersected N. & S. line 31 Links North of Section Corner.

West on true line between Secs. 4 and 9.

39.97 Set  $\frac{1}{4}$  Section Post on true line.

North on line between Sections 4 and 5

40.00 Set  $\frac{1}{4}$  Section Post.

82.17 Intersect the Township Line 142 links West of post in mound where raised a Mound in which set a post for Corner of Sections.

Translate the above notes into a plat showing the various divisions with areas within the Section usually shown on Government Survey Maps.

(Note—This is a section exceeding standard size and area. The Government Land Office divided the North half of these sections into various lots. Show these by their number and area.)

Snyder engages you to survey: "The S. 70 Acs. of the S.E.  $\frac{1}{4}$  of Sec. 4 T N. R etc. described also as the S. 70 Rods of said S.E.  $\frac{1}{4}$ "—which is the description by W. D. from Brown dated July 1st, 1953.

Upon investigation of titles you find that Brown acquired title from Jones by the same description in 1922 and that under the same date Jones deeded to Simms "The N. 90 Acres of the S.E.  $\frac{1}{4}$  of Sec. 4 described also as the N. 90 Rods of said S.E.  $\frac{1}{4}$ ."

Jones held title to the South half and the South half of the N.W.  $\frac{1}{4}$  of Sec. 4 by deed dated November 9th, 1900 and constructed a road, the South line of which substantially followed the North line of the tract he deeded to Brown and by custom continued to use the same. Brown took possession of his land by living upon the premises and farming same and also leased Simms' 90 Acres until Simms' recent death, therefore for no necessity arose to establish a division line between these holdings.

## Your Survey Notes Are As Follows:

Find stone for N.E. Cor. Sec. 4 which is 61.66 W. of stone for S.E. Cor. Sec. 33.

## E. Line Sec. 4

Meas. S. from stone N.E. Cor. Sec. 2854.00 Approx. center rail fence to W. 5505.55 Stone for S.E. Cor. Sec. Dig for  $\frac{1}{4}$  Cor. Find nothing.

## S. Line Sec. 4

Meas. W. from stone S.E. Cor. Sec. 2650 About plow line to N. 3969.50 E. face Fence to N. 5292.00 Stone for S.W. Cor. Sec. Find nothing for  $\frac{1}{4}$  Corner.

## W. Line Sec. 4

Meas. N. from stone S.W. Cor. Sec. 3971.0 Line of fence to E. 5439.65 Iron Pipe N.W. Cor. Sec. 4.

## On Town Line

Meas. E. on line from pipe N.W. Cor. Sec. 4. 94.00 Stone for Cor. Secs. 32 and 33. 2738.00 Stone for S.  $\frac{1}{4}$  Cor. Sec. 33. 5320.35 Stone for N.E. Cor. Sec. 4.

## N. Line Sec. 4

Run N. line Sec. 4 by Stone N.E. Cor. and pipe N.W. Cor. Sec. 4. Come 0.25 N. of Stone for S.  $\frac{1}{4}$  Cor. Sec. 33.

## E. Line Sec. 4

By Stone at N.E. Cor. and at S.E. Cor. Sec. Angle with N. line as run from S. to W.  $88^\circ 45' 25''$  (Average of 6 readings).

## S. Line of Sec. 4

By Stone S.E. Cor. and S.W. Cor. Sec. Angle with E. line Sec. as run from W. to N. =  $90^\circ 32' 10''$  (Average 6 readings).

The Government Survey is the same you had as Problem No. 1. Use it.

Question: Locate the quarter corners of the section by your survey.

Question: Make a plat of survey of the land you are surveying showing the essential lines and measurements there-to which will clarify the ambiguity in the description.

## Show All Your Work

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PS 2—A surveyor is called upon to establish the boundary lines of the South half of Section 23 T. N., R E. of the 3rd P. M. The East three quarters of this section is heavily wooded and covered with dense underbrush. His survey notes are as follows:

Aug. 15th, 1952 Temp.  $90^\circ$  Smith, Jones & White.

## N. Line of Sec. 23

Find stone at N.E. Cor. of Section per references B. 90 P. 120 and measure West from same leaving flag facing West.

2640 Leave temporary stake.

5310.00 Stone, N.W. Cor. Section.

At 2655.00 find iron pipe for N.  $\frac{1}{4}$  cor. on line between stones of Section corners.

## On W. Line Section

Measure S. from stone N.W. Cor. Section.

2600 Leave temporary stake.

5303.48 Stone for S.W. Cor. Section.

Run line by stone N.W. Cor. and S.W. Cor. Sect.

Angle with N. line Section from E. to S.

Average of 5 Readings =  $90^\circ 24' 36''$ .

Call W. line section North and South—making course of N. line S.  $89^\circ 35' 24''$  W.

Find monument for W.  $\frac{1}{4}$  Cor. at 2651.00 and  $6.10^\circ$  E. of straight line.

## On S. Line of Section

Measure East from stone at S.W. Cor. Section.

2648.20 Center of 4" tile filled with concrete for S.  $\frac{1}{4}$  Cor. of Section.

5296.40 Center of 4" tile filled with concrete for S.E. Cor. of Section.

Angle—Straight W. line section through mile with tile for S.  $\frac{1}{4}$ —North to East. Average 5 Readings =  $89^\circ 40'$ .

Produce S. line S.W.  $\frac{1}{4}$  East.

Comes 2.80 North of tile at S.E. Cor. Sec.

#### E. Line Section

This line is through heavy timber and dense underbrush.

Clear brush and follow an old fence line. Angle with S. line of S.E.  $\frac{1}{4}$  by tile at S.E. Cor. Section and S.  $\frac{1}{4}$  Cor.

Average of 3 Readings W. to N. =  $90^\circ 36' 22''$ .

By calculation call line N.  $0^\circ 20'$  E. with reference to straight W. line of section. Measure N. on this line from tile S. E. Cor. Sec. 1500  $\pm$  N. end of old fence.

1600 Set Stake.

Over stake deflect  $1^\circ 40'$  N. to W. and measure N. on this line from stake at 1600.

At 2000 on this line set stake.

Over this stake deflect  $9^\circ 05'$  N.W. to E. and measure N. along line.

At 1714.78 we are opposite to by Right angle and 15.96 S.E. of Stone at N.E. Cor. of Section.

On course  $1^\circ 40'$  N. to W. set stake which is at 1057.05 in 200 ft. measmt. and turn angle S. to E.  $88^\circ 40'$ .

Find old pipe surrounded by stones in brush. It is 1.22 N. of line turned off 2000 ft. course and 30.75 E. of stake at 1057.05 noted.

You are to use these notes to determine the length of the East and North lines of the survey, and set a monument at the center of the section.

Show all details of your work.

PS 3—Write a description for the tract of land, the corners of which are designated by letters A to F.

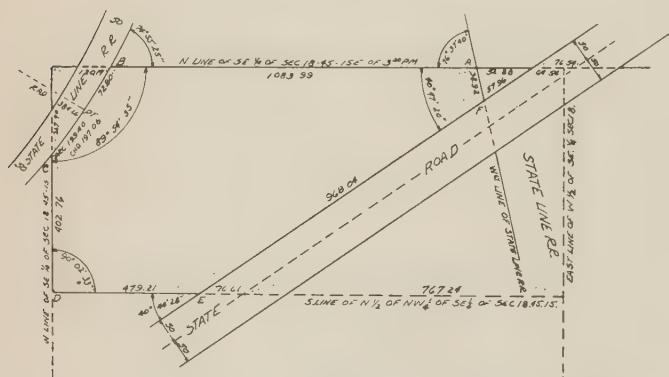


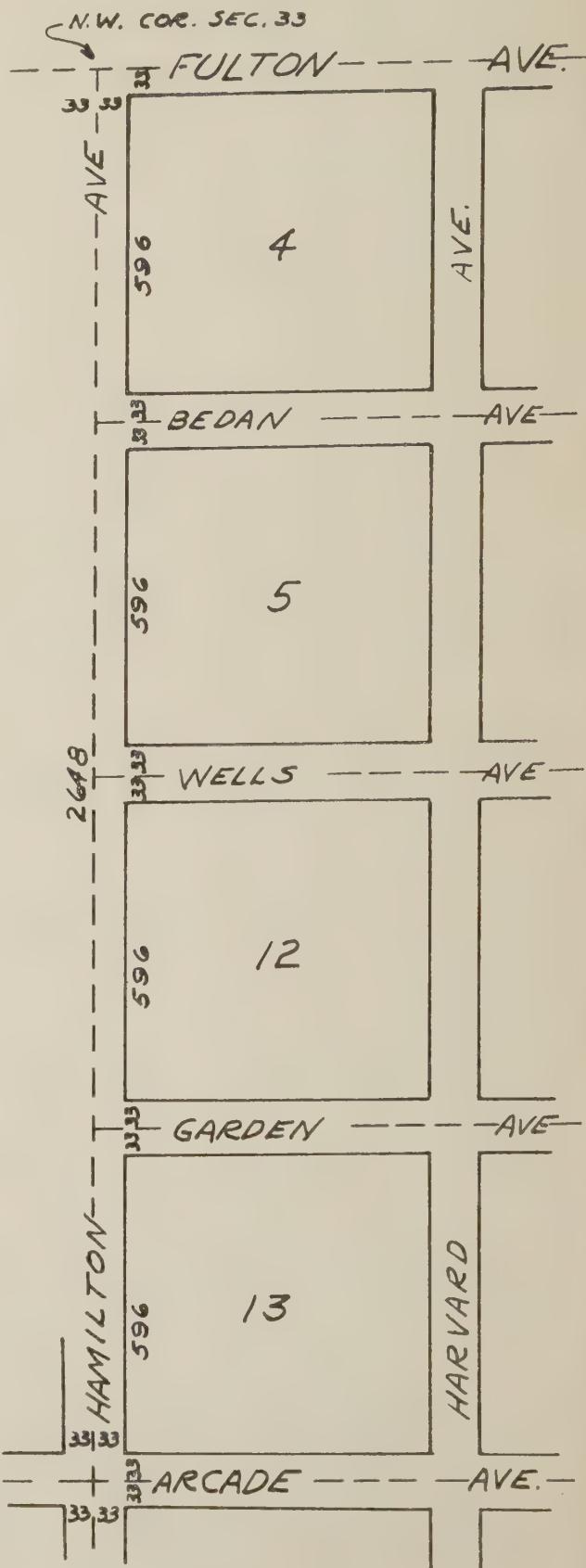
Figure 3

Write a brief summary of your method of procedure as a land surveyor to establish the corner of:—"A 3 Acre tract of land in the Northeast corner of the West Half of Government Lot One in the Northeast Quarter of Section Six, Township 42 North, Range 9 East of the Third Principal Meridian, Cook County, Illinois."

The Government Survey shows the South line of Sec. 6 as 80.40 Chains; the north line as 80.30 Chains; the East line as 79.00 Chains and the West line as 80.60 Chains.

PS 4—You are surveying the N.W.  $\frac{1}{4}$  of Sec. 33 and run the East line of Hamilton Ave. by S.W. Corner of 3 story brick N.E. cor. Arcade Ave. which is 65.82 East of brick N.W. cor. Arcade Ave. and by cross notch in walk for S.E. corner Fulton.

Figure 4



Comes 0.16 E. of cross notch 50 ft. S. of Fulton  
 Comes 0.15 E. of N.W. cor. brick 65 ft. S. of Fulton  
 Comes 0.18 E. of N.W. cor. brick 290 ft. S. of Fulton  
 Comes 0.21 E. of S.W. cor. brick 315 ft. S. of Fulton  
 Comes Right with cross notch 350 ft. S. of Fulton  
 Comes 0.02 W. of cross notch 400 ft. S. of Fulton  
 Comes 0.33 E. of cross notch 425 ft. S. of Fulton  
 Comes 0.29 W. of S.W. cor. 3 Sty. brick 480 ft. S. of Bedan  
 Comes 0.21 W. of cross notch 480 ft. S. of Bedan  
 Comes 0.63 W. of N.W. cor. 3 Sty. brick 25 ft. N. of Wells  
 Comes 65.75 E. of Main face Iron Column N.W. cor. Wells  
 Comes 65.63 E. of Notch N.W. cor. Wells  
 Comes 0.42 W. of Notch in walk S.E. cor. Wells  
 Comes 0.56 E. of Stone water table to brick N.E. cor. Bedan  
 Comes 0.07 W. of main face brick N.E. cor. Bedan  
 Comes 0.21 W. of cross notch 5 ft. S. of N.E. cor. Bedan  
 Comes 0.61 W. of stone water table to brick S.E. cor. Bedan  
 Comes 0.36 W. of cross notch 310 ft. S. of S.E. cor. Bedan  
 Comes 0.27 W. of cross notch 410 ft. S. of S.E. cor. Bedan  
 Comes 0.49 W. of cross notch 410 ft. S. of S.E. cor. Bedan  
 Comes 0.39 W. of N.W. cor. 3 Sty. brick 410 ft. S. of Bedan  
 Comes 0.42 W. of S.W. cor. of brick 25 ft. S. of S.E. cor. Wells  
 Comes 0.56 W. of N.W. cor. of brick 25 ft. N. of N.E. cor.  
 Garden  
 Comes 65.47 E. of N.E. cor. of brick 25 ft. N. of N.W. cor. of  
 Garden  
 Comes 0.46 W. of notch in curb 18 ft. S. of N.E. cor. Garden  
 Comes 0.50 W. of cross notch 5 ft. N. of S. line of Garden  
 Comes 0.18 W. of N.W. cor. 3 Sty. brick 215 ft. N. of N.E. cor.  
 Arcade  
 Comes 0.06 W. of N.W. cor. 3 Sty. brick 48 ft. N. of N.E. cor.  
 Arcade  
 Comes 0.03 W. of S.W. cor. 3 Sty. brick 24 ft. N. of N.E. cor.  
 Arcade  
 Comes 0.06 E. of N.W. cor. 3 Sty. brick 24 ft. S. of S.E. cor.  
 Arcade

Either by calculation or diagram indicate how you would determine the location of the origin of variation from the straight East line of Hamilton Ave. as shown by the Canal Trustees Subdivision into 10 Acre Blocks.

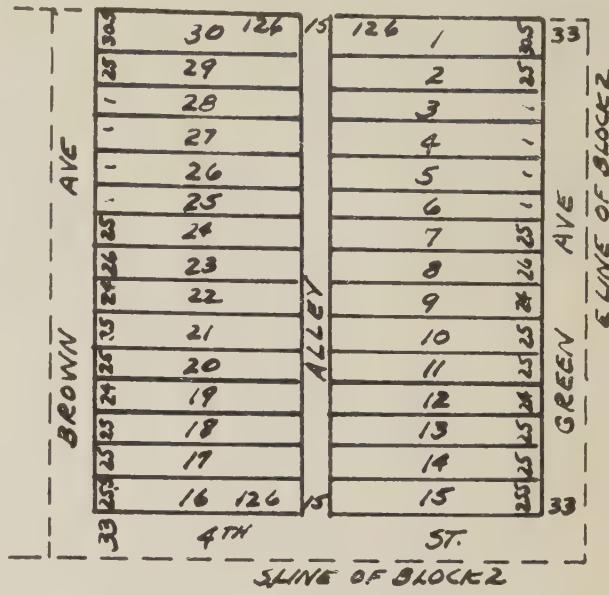
The measurement of length of half mile is as of today.

**PS 5**—In 1858 Waite subdivides the E.  $\frac{1}{2}$  of S.W.  $\frac{1}{4}$  of Section 2 into 8 blocks, each measuring 10 Chains on the North and South lines of the blocks, and 10.04 Chains on the East and West lines of the blocks per recorded plat. Brown acquires the North 3.79 chains of Block 2 in 1860 and shortly thereafter Abell purchases the South 6.25 Chains of said block, which is at the N.W. corner of Waite's subdivision.

In 1875 Brown subdivides "The North 3.79 Chains of Block 2" into lots, streets and alleys—as partially shown by sketch:

N. LINE OF BLOCK 2 & N. LINE SW $\frac{1}{4}$ SEC 2	
BROWN AVE	ST 3
3RD	
18 126.9	15 126.9
17	17
16	2
15	3
14	4
13	5
12	6
11	7
10 126.9	8
	9
	10

In 1878 Abell subdivides "The South 412.5 feet of Block 2" etc. into lots, streets and alleys, partially shown by sketch as per recorded plat.



In 1887; Mellan; a surveyor, is called upon to make a survey for building purposes and a re-subdivision for convenience of description of "Lot 9 in Brown's Subdivision, and of the North 25.50 feet of Lot 1 in Abell's Subdivision." His notes for survey (in part) read as follows:

#### Green Ave.

Measure South from old stake S.W. Cor. 3rd St.

- 193.14 Remains of stake for N.E. Cor. Lot 9  
 597.70 Old cedar stake N.W. Cor. 4th St.  
 663.68 Old cedar stake S.W. Cor. 4th St.  
 2588.68 Old stake N.W. Cor. 7th St. which is 33 ft. N. of Section line.

$$\frac{66}{42654.68} = \frac{1}{2} \text{ Mi. Meas.}$$

663.67 = Measmt. per Block

66.00 379.50

597.67 = N. line 4th St. —25.50

354.00 354.00

243.67 = S. line of N. 25  $\frac{1}{2}$  ft. of lot 1, Abell's.

193.14 In survey—I include 1.03 ft. strip between Brown's and Abell's Subn. in my re-subdivision.

N. LINE LOT 9 BROWN'S SUB.	
ALLEY	GREEN AVE
15	126.9 1
17	2
17 1/2	3
17	126.9
15	S. LINE OF N. 25 $\frac{1}{2}$ FT OF LOT 1 ABELL SUB.

A brick apartment building was built covering the premises. The North and South walls of same being substantially on the North line of Lot 1 and the South line of Lot 3. Plat was Recorded.

You are surveying Lot 1; except the North 25½ ft. thereof; and all of Lot 2 in Abell's Subdivision—and your measurement on Green Ave. from 3rd to 4th St. practically agrees with Mellan's—being 597.70 ft.

Where will you place your property lines? Give an analysis of your reason for placing same at your distance from 3rd and 4th Sts.

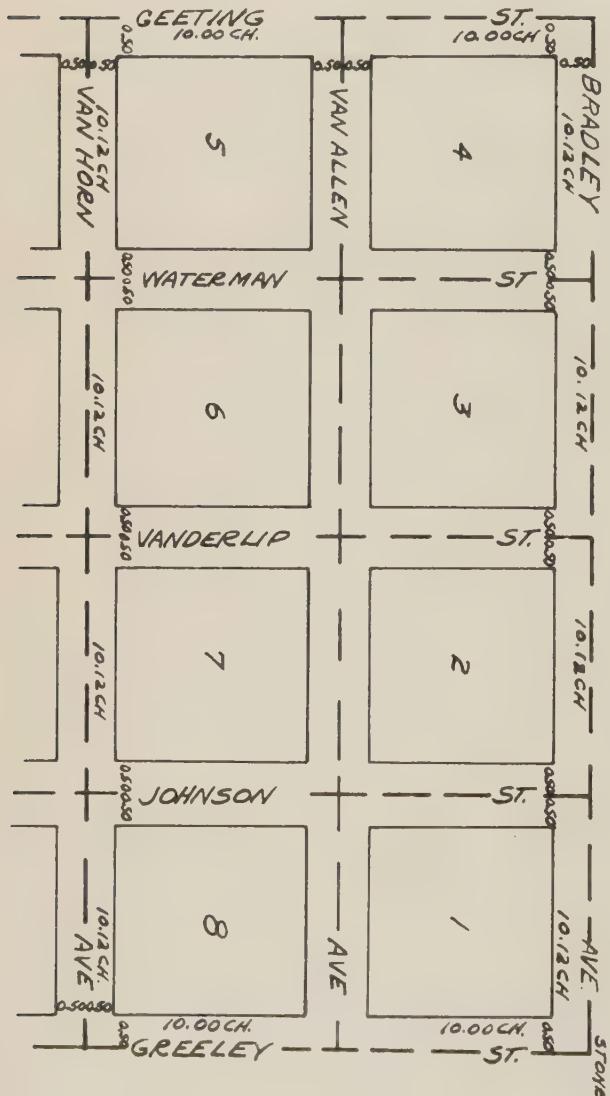
**PS 6**—You are making your first Survey in Wm. Perches' Subdivision, etc. as shown on left below which is of Lots 13, 14, 15 and 16 in Block 1 in Pattison's Subdivision of Blocks 1 and 8 in Wm. Perches' Subdivision, etc. Also shown on right below.

The following are part of field notes.

#### Bradley Ave.

Measure West along South line from 33 ft. E. of West line Greeley St. as run by notch in curb at S.W. cor. Bradley and by notch in walk at N.W. cor. Van Horn Ave.

58.02 Joint between 2 Story bricks



107.98	Notch
133.04	Notch
277.82	Notch
301.84	Notch
325.85	Notch
638.01	Notch S.E. Cor. Johnson St.
703.93	Notch S.W. Cor. Johnson St.
1309.42	Cross notch S.E. Cor. Vanderlip St.
1375.12	Notch S.W. Cor. Vanderlip St.
1980.84	West face brick S.E. Cor. Waterman St.
2046.35	Notch S.W. Cor. Waterman St.
2046.82	Notch S.W. Cor. Waterman St.
2651.33	West face brick S.E. Cor. Geeting St.
2717.53	Notch and line of brick S.W. Cor. Geeting St.

Determine the location for the East and West lines of your survey and the points for the lines of Johnson, Vanderlip and Waterman Sts. and make such suggestions which are pertinent to same.

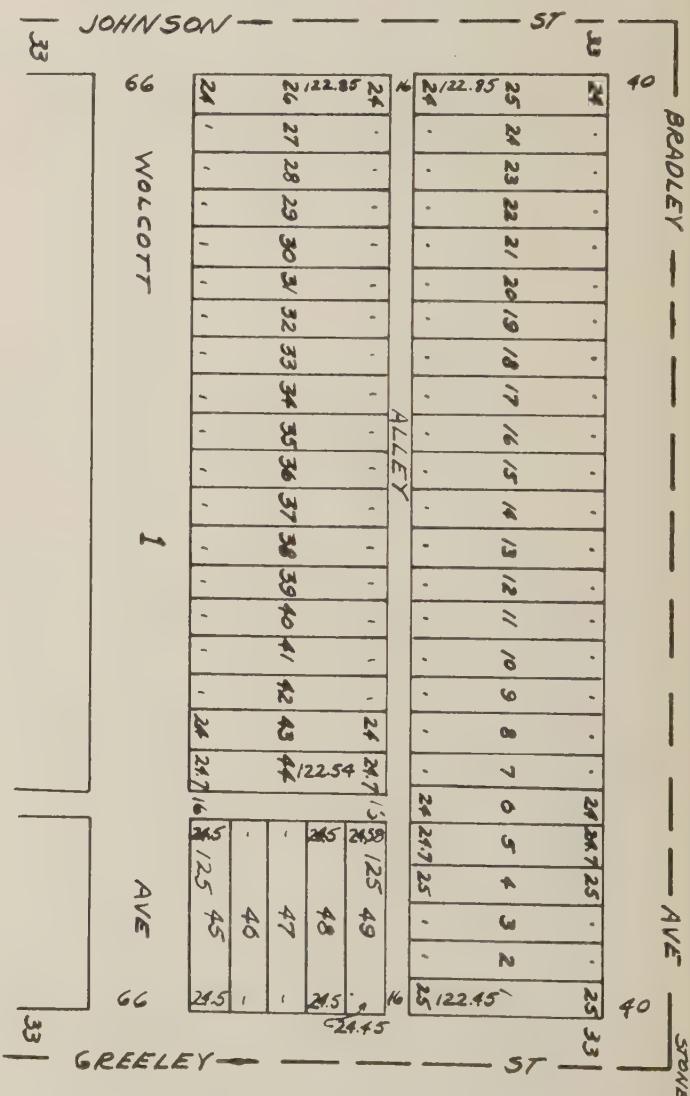


Figure 6

**PS 7**—You are to make a survey of Lot 10 in Block 2 in Braefield. A subdivision of the N.E.  $\frac{1}{4}$  of the S.W.  $\frac{1}{4}$  of the N.E.  $\frac{1}{4}$  of Sec. 15. . . . The recorded plat of which is herewith shown.

Some years ago your office made a complete survey of Section in subdividing the S.E.  $\frac{1}{4}$  of the N.E.  $\frac{1}{4}$  of Section 15. The following is a sketch showing your office measurements of the quarter section. The notes contain no reference of any survey corners found in the work in the interior of the N.E.  $\frac{1}{4}$ —and you find "Braefield" was actually surveyed and staked 10 years prior to your office's work; but was not recorded until a year after your office's subdivision was made and recorded.

The N.E.  $\frac{1}{4}$  of Sec. 15 is partly in timber and was used almost wholly for pasturage. There is no dispute as to section or quarter section corners, nor the location of center of section. The notes for your survey of Lot 10 in Block 2 are as follows:

Aug. 10th 1952 Temp. 90° Cypress St.

Measure W. from point 66 ft. W. of our notch in walk opposite pipe N. E. Cor. Hyacinth.

- 0.12 E. face brick N.W. Cor. Hyacinth  
123.12 S.W. Cor. brick garage N.E. Cor. alley  
139.15 Line of E. face brick W. side alley  
179.00 W. face of fence

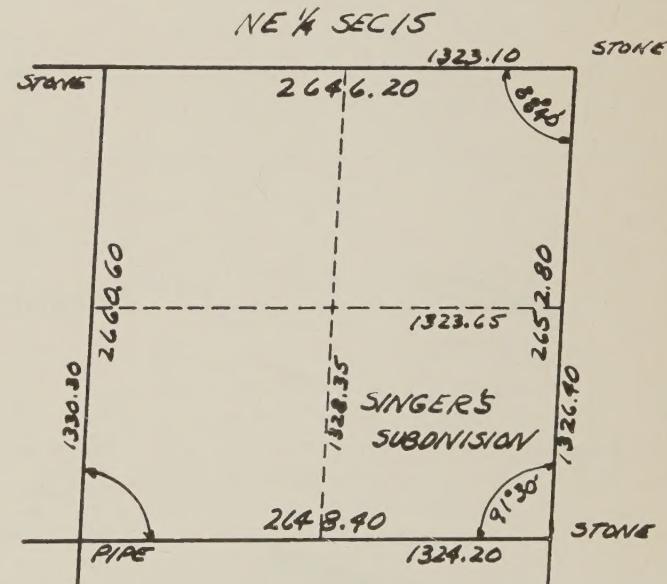
- 219.11 Notch in walk  
 339.16 E. face of fence  
 379.10 E. face of fence  
 439.06 Notch  
 499.05 Notch  
 594.90 Iron pipe N.E. Cor. Holly  
 661.80 Concrete Monmt. N.W. Cor. Holly.

Oak St.

Measure E. from notch opposite Iron pipe S.E. Cor. Holly,  
which is 66.60 E. of Conc. Monmt. of S.W. cor. streets.

- 55.46 Notch opposite pipe  
 135.45 Notch  
 215.44 Notch  
 255.50 Line of W. face of fence  
 295.40 Line of E. face of fence  
 375.40 Notch  
 415.40 Notch  
 455.40 Notch  
 595.08 Notch S.W. Cor. Hyacinth  
 596.40 Notch S.W. Cor. Hyacinth  
 661.07 Our notch S.E. Cor. Hyacinth

Where do you place the side lines of Lot 10 with relation to the line of Hyacinth Ave. and where do you place the cause of variation in the line of Hyacinth Ave. and Holly Ave.



The February issue will reproduce land surveyor examination questions in mathematics and legal questions.

At some later date the entire two sets of questions will be bound in one book and will be available for distribution at a nominal price.

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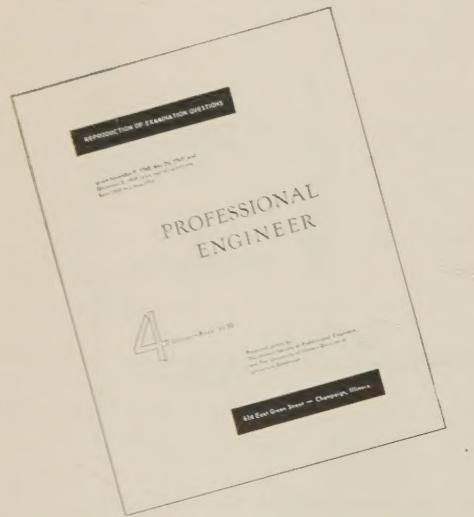
The Associated General Contractors of Illinois have announced the winners of the 1955 \$4,000 University of Illinois, Civil Engineering scholarships. Two more winners will be selected in 1956; however, time is short for your entry. The rules of the contest include an essay on the subject "Highway Engineering as a Career." If your son or your neighbor or any acquaintance of yours is interested in competing for this \$4,000 prize, which is paid at \$1,000 a year for four years, a note or postcard to the Associated General Contractors of Illinois, 319 South Sixth Street, Springfield, Illinois, will bring an application and all the details.

It is interesting to note that two of the three judges, namely Professor Ellis Danner and Chief Highway Engineer Ralph Bartelsmeyer, are members of the Illinois Society. The third member is Associate Dean Stanley Pierce, College of Engineering. Also, it is interesting to note that many of the contractor members of the Associated General Contractors are individual members of the Illinois Society.

Congratulations and best wishes from the Illinois Society to the Associated General Contractors.

Worry is like a rocking chair. It gives you something to do but doesn't get you anywhere.

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### COVER PICTURE

The cover picture, an excellent picture of the State of Illinois new State Office Building, is particularly timely this month inasmuch as the Illinois Society is working closely with the State of Illinois in several areas. Acknowledgment for the use of this picture is made to Director Edwin A. Rosenstone, Director of Public Works and Buildings.

The building is an excellent example of the excellent functional use of available space and the pleasing way it has been done.

### SERIOUSLY SPEAKING

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